



Saving Lives and Property Through Improved Interoperability

Embedded Communications Broker (ECB) Technology

White Paper

Final

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Impart Technology Inc., a venture capital supported company located in Austin, Texas, has announced a new product purported to ease connections, communications, and interoperability between the myriad wireless devices now available in the commercial marketplace. This new technology tool, called the Embedded Communications Broker (ECB), is a software program that is part of a software development kit. It offers opportunities for creating seamless, peer-to-peer¹ communications between dissimilar devices while incorporating flexibility and expandability to support legacy and emerging protocols, devices, and technologies.

The ECB offers a wireless communications solution by providing an interface between a variety of different wireless devices such as cellular telephones, personal computers (PC), digital cameras, MP3 players, telematics² devices, Global Positioning System (GPS) devices, printers, or any mobile or embedded device systems. The intent of this new technology is to expedite communications and interoperability between devices, operating systems, and applications systems without creating device- or application-specific interfaces or requiring a wireless connection of a mobile or handheld device to a host system.

Background

The ECB solution is primarily a response to the lack of sufficient interoperability between handheld devices that normally require developing specific point-to-point interface solutions. In many cases, these specific interfaces fall short of expectations because they do not offer standard methods for allowing communications between different devices, operating systems, and data formats, nor do they provide the ability to allow dynamic upgrades when new devices are added. Many existing handheld devices provide some form of rudimentary connectivity but do not support functionality that would allow them to be truly interoperable because of significant differences in the respective data formats used. The ECB solution tries to expand this basic connectivity and provide communications and appropriate data transfers between disparate devices.

The multitude of different devices, operating systems, connectivity protocol options, and incompatible applications compound an already complex and difficult communications situation between these dissimilar devices. Over the past 5 years, an estimated 750 million cellular telephones and approximately 15 million personal digital assistants (PDA) have been placed into use. Analysts expect that this market will continue to accelerate and some two billion devices will be in service within the next 48 months. All of these devices will run on various wireless communications protocols including 802.11a,³ 802.11b,⁴ and/or Bluetooth.⁵

Public safety agencies will likely be a part of this exponential growth in the handheld wireless device marketplace. More and more of these agencies are examining and incorporating

¹ Peer-to-peer refers to network architecture in which each workstation has equivalent capabilities and responsibilities.

² Refers to the broad industry related to the use of computers in concert with telecommunications systems. This includes dial-up service to the Internet as well as all types of networks that rely on a telecommunications system to transport data.

³ 802.11a—an extension to 802.11 that applies to wireless local area networks (LAN) and provides up to 54 megabits (Mbps) in the 5 gigahertz (GHz) band. 802.11a uses an orthogonal frequency division multiplexing encoding scheme rather than frequency hopping spread spectrum (FHSS) or direct sequence spread spectrum (DSSS).

⁴ 802.11b (also referred to as 802.11 High Rate or Wi-Fi)—an extension to 802.11 that applies to wireless LANs and provides 11 Mbps transmission (with a fallback to 5.5, 2, and 1 Mbps) in the 2.4 GHz band. 802.11b uses only DSSS. 802.11b was a 1999 ratification to the original 802.11 standard, allowing wireless functionality comparable to Ethernet.

⁵ Bluetooth refers to a short-range radio technology aimed at simplifying communications among network devices and between devices and the Internet. It also aims to simplify data synchronization between network devices and other computers.

these smaller devices for specific operations within various public safety agencies. Some of this use has been as a result of Community Oriented Policing Service Making Officer Redeployment Effective (COPS MORE) funding and other community-policing initiatives that deploy law enforcement personnel in non-traditional settings and vehicles, requiring alternative mobile data devices. Fire and emergency medical services personnel are also using non-traditional wireless data technologies for fire prevention, inspections activities, triage, patient care and reporting. Public safety departments have embraced these smaller devices in the interest of portability, cost, and enhanced application support in lieu of a wirelessly connected mobile data terminal or notebook computer.

The public safety vendor community, specifically those vendors who provide computer-aided dispatching and records management systems have also joined this trend to port their applications or subsets of the applications to these smaller devices. However, many of the vendors who provide solutions to the public safety community continue to develop “one-off interfaces” for specific applications supported on handheld devices. The inconsistencies and lack of interoperability continue to exist. It is rare to find a mobile data device or system that can communicate with a dissimilar system or device operating in the adjacent city or county.

Technology Overview

Figure 1, provided by Impart Technologies, depicts the chaotic situation existing among the various devices, multitudes of applications, connectivity, and operating systems.

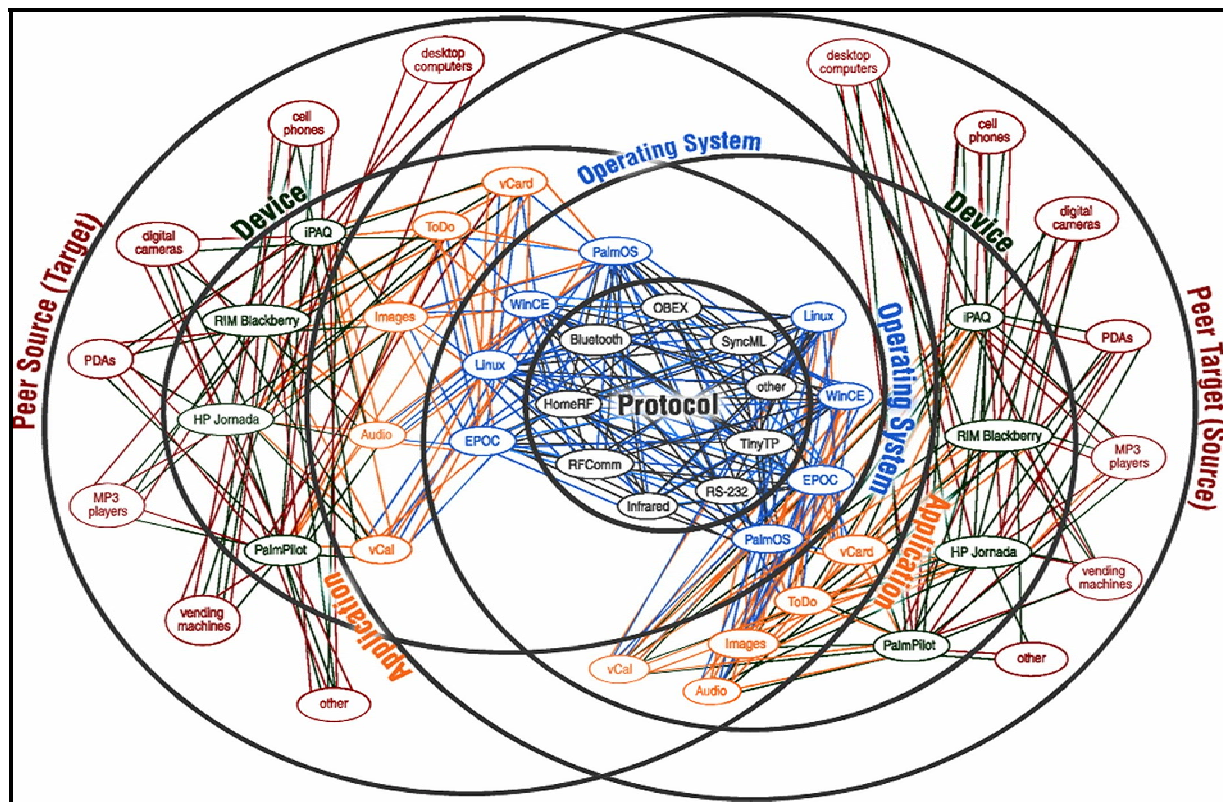


Figure 1
Depiction of the State of Interoperability Among Wireless Devices

As public safety agencies continue to contemplate and develop wireless data solutions that will extend agency information technology resources, the advent of connectivity technology solutions, such as the ECB, may become significant in both internal and external wireless communications.

The ECB solution, offered by Impart Technologies, Inc., is a common communications platform available to device manufacturers and applications developers to include in their various offerings. The ECB provides the following features to support interoperability between different mobile devices in a close proximity, peer-to-peer environment—

- Provides direct, transparent, high-speed, no-cost transfer of device-to-device information between different mobile, handheld, and embedded communications devices
- Incorporates a small footprint design specifically targeted to embedded systems
- Supports an asymmetrical architecture that eliminates the need for common software on all sides of the information exchange
- Provides an expandable architecture that dynamically provides support for devices as new applications, protocols, and devices are introduced into the marketplace
- Offers a common, compact, protocol-independent communications facility for developers and manufacturers that permits the deployment of interoperable mobile applications
- Operates across many physical communications interfaces including IrDA,⁶ Bluetooth, USB,⁷ RS-232,⁸ 802.11b, etc.
- Has a brokering structure that is compact and supports message handling, transformer selection, buffering and queuing, and message switching
- Provides a layer between the device and applications that serves as a construction area for developers to build applications without being overly concerned about connectivity and data formats
- Provides data routing between applications on different devices with transparent addressing of data formats and protocols.

Although the new generation of mobile data devices may bring significant change to the mobile communications landscape, that change appears to address only the communications

⁶ Infrared Data Association, a group of device manufacturers that developed a standard for transmitting data via infrared light waves.

⁷ Universal Serial Bus, an external bus standard that supports data transfer rates of 480 Mbps. A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards.

⁸ Recommended Standard-232C, a standard interface approved by the Electronic Industries Association (EIA) for connecting serial devices. In 1987, the EIA released a new version of the standard and changed the name to *EIA-232-D*. In 1991, the EIA teamed up with Telecommunications Industry association (TIA) and issued a new version of the standard called *EIA/TIA-232-E*.

aspects of transferring information. The emergence of Bluetooth, 802.11b, and the forthcoming 802.11a wireless technology provides a connectivity path, but does very little to address the real differences between applications and data formats supported by these applications. While the devices can connect, the ability to support actual transfer of data and information continues to be costly and difficult, and the problem is worsened when different manufacturer's devices are involved.

Impart Technologies offers the following metaphor to further explain its ECB technology solution: *"If you place a phone call to Italy, you can make a connection, but you will not likely be able to communicate unless both parties can speak the same language."*

The core of the ECB is a common, protocol-independent, communications software application. This software application is dynamically upgradeable to support new mobile devices, which makes the ECB more cost effective to maintain and support. The core technology provides the functionality to allow both peer source and peer target communications. The small size of the embedded software code set is efficient and compact and allows the software to be embedded within a device's hardware. The ECB provides automatic configuration for only needed devices and applications and supports the flexibility to add support for additional platforms as required. This flexibility provides robust opportunities for more complex protocols and data streams and allows manufacturers to rapidly adapt to changing or emerging new standards when new devices or requirements are released.

The ECB contains four primary parts. Depicted in Figure 2 is the high-level architecture of the ECB.

- **Embedded Communications Broker**—The ECB facilitates a wireless connection between different devices, and performs the necessary steps to translate the data or information to the other applications through the use of software. This software is a common, protocol-independent layer available to developers and device manufacturers. The ECB implements basic peer-to-peer communications across disparate devices.
- **Event Handler**—Basically, an event handler manages the conversations between the devices, and provides near real-time information necessary to define and establish the actual connection and interface protocols. These communications are similar to a UML⁹ event. These events delineate a significant occurrence that has a location in time and space. Some event handlers include adapters and can support actions that will more directly affect the outside world, such as sending data over Bluetooth or a wireless LAN connection. Other event handlers are located inside the ECB and perform intermediate protocol and data transformation.

⁹ Unified Modeling Language, a general-purpose notational language for specifying and visualizing complex software, especially large, object-oriented projects. UML builds on previous notational methods such as Booch, Object Modeling Technique (OMT), and Object Oriented Software Engineering (OOSE). It is being developed under the auspices of the Object Management Group (OMG).

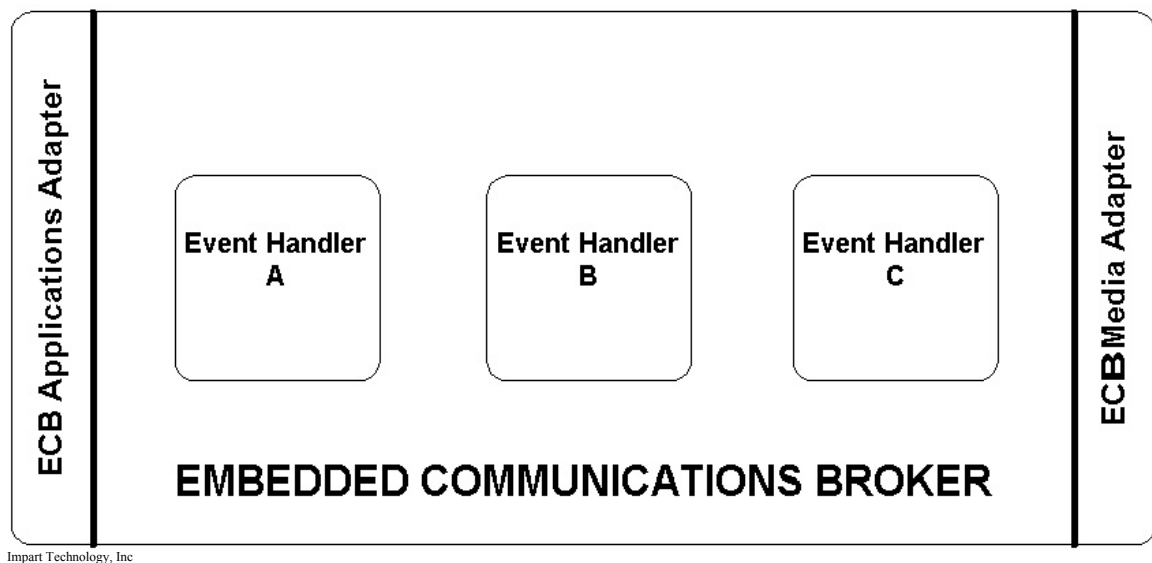


Figure 2
ECB Architecture

- **ECB Application Adapter**—This is part of the software application that facilitates communications between applications residing on the device and the ECB. The ECB can support multiple interfaces, and it provides a common interface for all applications residing on a user device. The applications adapter can have three settings—receive only, send only, or receive and send.
- **ECB Device Adapter**—This is part of the software application that facilitates communications from the ECB to the target user device. The Device Adapter serves as an interface that defines the type of the host device and the communications protocol (physical layer connection) that the host and target (e.g., Palm, cell phone, IrDA, 802.11b, Bluetooth) will use.

Public Safety Impact

The potential importance of this type of technology to public safety stems from the ability of two dissimilar mobile data devices such as two notebook PCs to actively interoperate in close proximity without a complex interface in place. While ECB-like technology will not, and should not, hinder efforts to create other types of interoperability between mobile data systems, it appears that it may have a place in emerging systems.

The ECB technology could be useful in mutual-aid situations where outside fire apparatus are called into an area to cover stations during major incidents. In most cases, the outside apparatus, if equipped with mobile data, would likely be unable to communicate on the host agency's system. If the host agency has deployed wireless local area network (WLAN) technology in the station for event notifications, the ECB could facilitate the interoperable communications between the station WLAN and the outside fire apparatus.

Anecdotal information indicates this type of communications technology would have been extremely beneficial during response to the recent terrorist attack on the Pentagon. During this incident, mobile data communications were severely hampered because of dissimilar

systems and incompatible devices, systems, and applications. Another potential use of ECB technology could be for task forces in lengthy incident operations involving different agencies with different types of handheld or vehicle mounted equipment. Through an ECB-equipped device at the incident command post, information could be passed to the various dissimilar devices through established peer-to-peer connections while each respective device is in close proximity to the command post.

Presently, Impart Technology Inc. is focusing its efforts in facilitating interoperations between different devices and applications in the commercial sector. This is a normal course of action, as most of today's emerging public safety technology was originally developed for commercial operation. Only after the technology has been proven in commercial venues is it modified to support the more critical public safety environment.